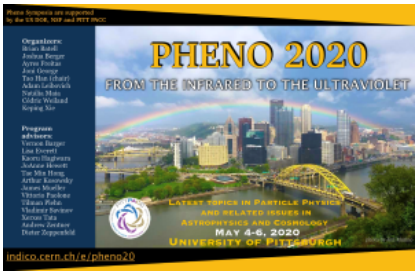

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Hunting Inflaton at FASER

Monday 4 May 2020 17:00 (15 minutes)

We explore a possibility that an inflaton, which drives the cosmological inflation in the early universe, can be detected by the recently approved FASER at the High-Luminosity LHC (HL-LHC). We consider nonminimal quartic inflation scenario in the minimal U(1)$_X$ extension of the Standard Model (SM) with the classical conformal invariance, where the inflaton is identified with the U(1)$_X$ Higgs field (ϕ). By virtue of the classical conformal invariance and the radiative U(1)$_X$ symmetry breaking via the Coleman-Weinberg mechanism, the inflationary predictions (in particular, the tensor-to-scaler ratio (r)), the U(1)$_X$ coupling (g_X) and the U(1)$_X$ gauge boson mass ($m_{Z'}$), are all determined by only two free parameters, the inflaton mass (m_ϕ) and its mixing angle (θ) with the SM Higgs field. FASER can search for the inflaton for the parameter ranges of $0.1 \leq m_\phi[\mathrm{GeV}] \leq 4$ and $10^{-5} \leq \theta \leq 10^{-3}$. Each point in the ($m_\phi$, θ)-plane searched by FASER has a one-to-one correspondence with inflationary predictions (r) and Z' boson search parameters (g_X and $m_{Z'}$) at the HL-LHC. Therefore, the cosmological observation, LHC experiment, and long-lived particle search at FASER are complementary to test our scenario.

Summary

We explore a possibility that an inflaton can be detected by the recently approved FASER at the High-Luminosity LHC.

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